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PATENT ABSTRACTS OF JAPAN(21) Application number: **08055721**(51) Intl. Cl.: **H01C 7/02 H01C 1/14**(22) Application date: **13.03.96**

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(43) Date of application publication: 19.09.97	(72) Inventor: MORIMOTO KOICHI IWAO TOSHIYUKI
(84) Designated contracting states:	(74) Representative:

**(54) CHIP PTC
THERMISTOR**

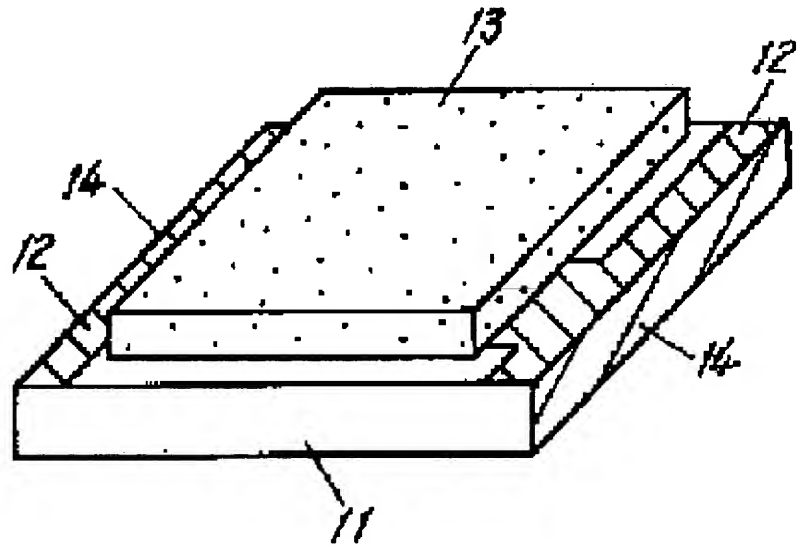
(57) Abstract:

PROBLEM TO BE SOLVED: To exclude deviation of a metal terminal, by forming a pair of T-shaped electrode layers on the upper surface of a substrate, and constituting conductive polymer electrically connected with the electrode layer.

SOLUTION: A substrate 11 contains 96% alumina having surface roughness of 3-4 μ m. On the upper surface of the substrate, T-shaped electrode layers 12 composed of nickel are formed from one end of the substrate toward the other end, and from the other end to the one end. Conductive polymer 13 is formed on the upper surface of the substrate 11, to be connected with a pair of the electrode layers 12. The polymer 13 is composition of crystalline polymer and conductive particles, and has PTC characteristics. Side surface electrodes 14 composed of silver are formed on the respective side

surfaces of the substrate 11, to be connected with the electrode layers. Thereby movement of the conductive polymer, the electrodes and terminals are reduced, so that mounting by a flow soldering method and repairing work are possible. It is also possible to make heat dispersion constant by forming an outer electrode having a thickness on the lower surface part of the substrate.

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CLAIMS

[Claim(s)]

[Claim 1] The chip form PTC thermistor which consists of a substrate, the T character mold electrode layer of the pair prepared in the top face of said substrate, a conductive polymer that has the PTC property electrically connected to said electrode, and a side-face electrode electrically connected with said electrode layer on the side face of said substrate.

[Claim 2] A conductive polymer is a chip form PTC thermistor according to claim 1 which is the constituent of a crystalline polymer and a conductive particle.

[Claim 3] The chip form PTC thermistor according to claim 1 which equipped the top face of a conductive polymer with the electrode.

[Claim 4] The chip form PTC thermistor according to claim 1 which equipped the inferior surface of tongue of a substrate with the side-face electrode and the electrode connected electrically.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention relates to the chip form PTC thermistor using the conductive polymer which has the PTC (it has Positive Temperature Coefficient= positive temperature coefficient) property of using for the circuit protection to the overcurrent and overheating by the short circuit of various electrical and electric equipment etc.

[0002]

[Description of the Prior Art] Hereafter, the conventional PTC thermistor is explained.

[0003] The conventional PTC thermistor is inserted from both sides of the conductive polymer (it is hereafter described as "Polymer PTC".) which fabricated the metal plate which split-face-ized the metallic foil which has 0.1-100-micrometer surface roughness in a U.S. Pat. No. 4689475 official report, and the front face to plate-like, and the manufacture approach which carries out thermocompression bonding is indicated.

[0004] Drawing 6 is the perspective view of the conventional chip form PTC thermistor. In drawing, 1 is the polymer PTC which comes to prepare a metallic foil 2 in a top and an inferior surface of tongue. 3 is the metal terminal prepared in the field of a polymer PTC 1 and the metallic foil 2 which counters through the solder layer 4. At this time, the edge of the metal terminal 3 was prepared toward one of fields.

[0005]

[Problem(s) to be Solved by the Invention] However, in order to join a metallic foil 2 and the metal terminal 3 in the solder layer 4, and to have to join this junction below 270 degrees C with the above-mentioned conventional configuration so that the crystalline polymer of the constituent of Polymer PTC may not deteriorate, The solder and the heat-resistant temperature which are used when a chip form PTC thermistor is mounted in a printed circuit board became equivalent, and it had the technical problem that the solder of a joint fused and the metal terminal 3 shifted at the time of mounting to the printed circuit board by the Floe process.

[0006] In order to solve the above-mentioned technical problem, this invention aims at offering the chip form PTC thermistor with which a metal terminal does not shift.

[0007]

[Means for Solving the Problem] In order to attain the above-mentioned purpose, this invention equips the top face of a substrate with the electrode layer of the T character mold of a pair, and has the conductive polymer electrically connected to this electrode layer.

[0008]

[Embodiment of the Invention] Invention of this invention according to claim 1 consists of a conductive polymer which has the PTC property electrically connected to the T character mold electrode layer and said electrode layer of the pair prepared in the top face of a substrate and said substrate, and a side-face electrode electrically connected with said electrode layer on the side face of said substrate.

[0009] Moreover, the conductive polymer according to claim 1 of invention according to claim 2 is the constituent of a crystalline polymer and a conductive particle.

[0010] Moreover, invention according to claim 3 equips the top face of the conductive polymer of invention according to claim 1 with an electrode.

[0011] Moreover, invention according to claim 4 equips the inferior surface of tongue of the substrate of invention according to claim 1 with a side-face electrode and the electrode connected electrically.

[0012] (Gestalt 1 of operation) The chip form PTC thermistor in the gestalt of 1 operation of this invention is explained hereafter, referring to a drawing.

[0013] The perspective view of a chip form PTC thermistor [in / in drawing 1 / the gestalt of 1 operation of this invention] and drawing 2 are drawings which removed the conductive polymer which is this important section.

[0014] In drawing, 11 is a substrate which comes to contain 96% of alumina which 3-4 micrometers of surface roughness have. 12 is the electrode layer of the T character mold of a pair which consists of nickel of the abbreviation mold for T characters formed in the top face of a substrate 11 toward the end from the other end and the other end from the end. 13 is the polymer PTC which has the PTC property which is the constituent of the crystalline polymer and the conductive particle which were prepared in the top face of a substrate 11 so that it might connect with the electrode layer 12 of a pair electrically. 14 is a side-face electrode which consists of silver prepared so that it might connect with an electrode layer electrically on each side face of a substrate 11.

[0015] About the chip form PTC thermistor constituted as mentioned above, the manufacture approach is explained below.

[0016] First, the nickel film is formed in the top face of a substrate 11 by the sputtering method, and FOTORISO etching is carried out so that it may become the electrode layer 12 of the pair of the pattern shown in drawing 2 .

[0017] Next, the mean particle diameter of 58 micrometers which manufactured high density polyethylene of 70 - 90% of crystallinity by 49 % of the weight and the furnace method, Antioxidizing material 50% of the weight for the carbon black of specific-surface-area of 38m²/g 1 % of the weight Mix for 20 minutes with 2 rolls heated at 150 degrees C at the heater, and this mixture is picked out from 2 rolls by the shape of a sheet. With the heat press machine which carried the polymer PTC 13 which cooled pressing down with a metal plate in order to set thickness to 1mm at homogeneity, and cut the sheet to the wafer in the top face of the substrate 11 in which the electrode layer 12 was formed, and was heated at 190 degrees C It presses for 10 seconds by the pressure of 20kg/cm², and a polymer PTC 13 is joined to a substrate 11. 20Mrad exposure of the joined polymer PTC 13 obtained here was carried out within electron-beam-irradiation equipment, and radiation-induced crosslinking was performed to high density polyethylene.

[0018] Finally, carry out spreading desiccation of the silver paste of an epoxy system so that it may be connected with the electrode layer 12, and a substrate 11 is made to fix on the side face in which a substrate 11 faces each other, the side-face electrode 14 used as the external electrode of a pair is formed in it, and a chip form PTC thermistor is obtained.

[0019] As mentioned above, the resistance temperature characteristic of the chip form PTC thermistor constituted and manufactured is shown in drawing 3 . Moreover, the current value which the resistance in the ordinary temperature (25 degrees C) of this chip form PTC thermistor energizes [1.2 ohms and] was 0.7A.

[0020] In addition, resistivity may become small, if the electrode 21 which consists of Ag is formed in the top face of a polymer PTC 13 as shown in drawing 4 .

[0021] Moreover, if an electrode 31 is formed so that it may connect with the side-face electrode 14 electrically at the flank of the inferior surface of tongue of a substrate 11 as shown in drawing 5 , the effect to the printed circuit board by heat leakage nature when a polymer PTC 13 generates heat mounted may become small.

[0022]

[Effect of the Invention] As mentioned above, since this invention has that a conductive polymer, an electrode, and a terminal are perturbed [little] by heating at the time of mounting, mounting and the repair activity of a Floe process are possible for it.

[0023] Moreover, the structure as for which heat leakage nature is made to regularity is also possible by forming the external electrode which could make resistance low or prepared thickness in the inferior-surface-of-tongue section of a substrate.

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TECHNICAL FIELD

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PRIOR ART

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TECHNICAL PROBLEM

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MEANS

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1] The perspective view of the chip form PTC thermistor in the gestalt of 1 operation of this invention

[Drawing 2] Drawing which removed the conductive polymer which is this important section

[Drawing 3] Drawing explaining this resistance temperature characteristic

[Drawing 4] The perspective view of the chip form PTC thermistor in the gestalt of other operations of this invention

[Drawing 5] The perspective view of the chip form PTC thermistor in the gestalt of other operations of this invention

[Drawing 6] The perspective view of the conventional chip form PTC thermistor

[Description of Notations]

11 Substrate

12 Electrode Layer

13 Polymer PTC

14 Side-Face Electrode

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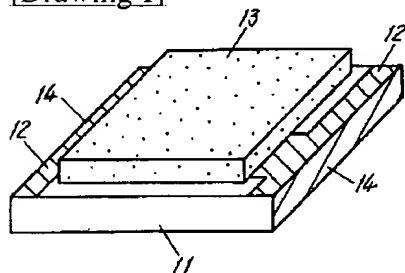
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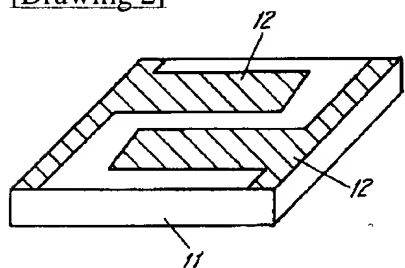
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DRAWINGS

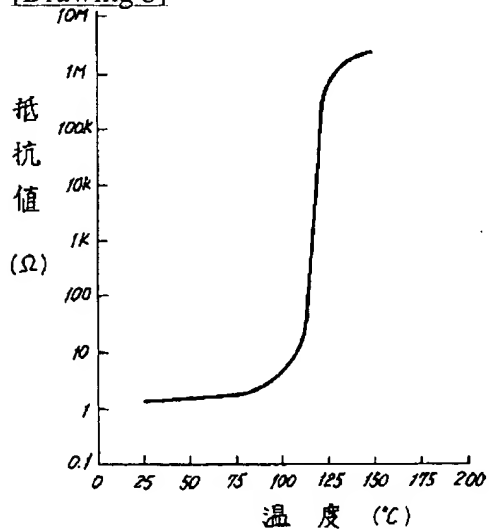
[Drawing 1]



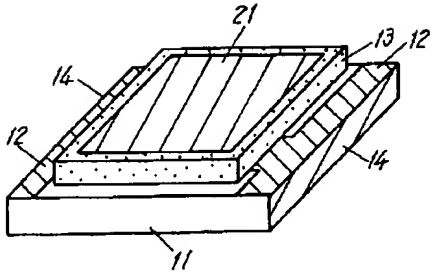
[Drawing 2]



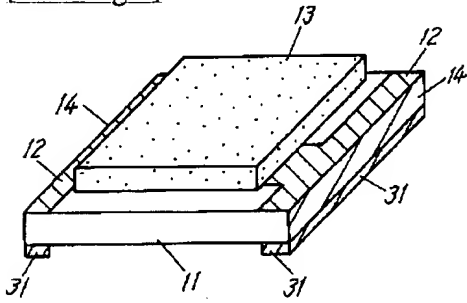
[Drawing 3]



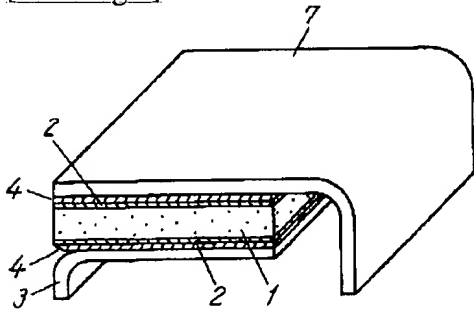
[Drawing 4]



[Drawing 5]



[Drawing 6]



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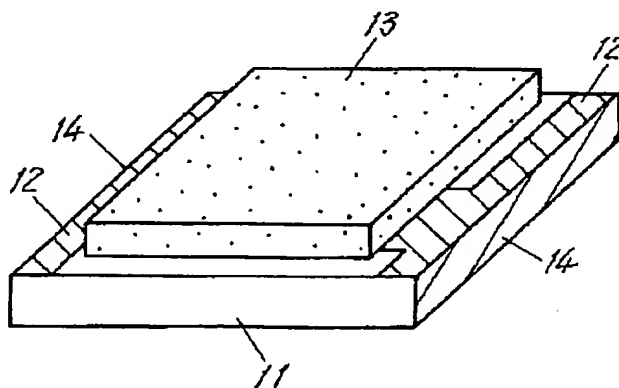
(74) 代理人 弁理士 滝本 智之 (外1名)

(54) 【発明の名称】 チップ形 P T C サーミスタ

(57) 【要約】

【課題】 各種電気電子機器に使用する P T C 特性を有する導電性ポリマを組成物とするチップ形 P T C サーミスタにおいて、実装時の加熱に、導電性ポリマと電極と端子が動じることがないものを提供することを目的とするものである。

【解決手段】 基板 1 1 と、基板 1 1 の上面に形成してなる T 字型の一対の電極層 1 2 と、電極層 1 2 上に形成されるポリマ P T C 1 3 と、基板 1 1 の対向する側面に電極層 1 2 と各々が接続している側面電極 1 4 とからなるものである。



【特許請求の範囲】

【請求項 1】 基板と、前記基板の上面に設けられた一対の T 字型電極層と、前記電極に電気的に接続する PTC 特性を有する導電性ポリマと、前記基板の側面に前記電極層と電気的に接続する側面電極とからなるチップ形 PTC サーミスタ。

【請求項 2】 導電性ポリマは、結晶性ポリマと導電性粒子との組成物である請求項 1 記載のチップ形 PTC サーミスタ。

【請求項 3】 導電性ポリマの上面に、電極を備えた請求項 1 記載のチップ形 PTC サーミスタ。

【請求項 4】 基板の下面に、側面電極と電気的に接続する電極を備えた請求項 1 記載のチップ形 PTC サーミスタ。

【発明の詳細な説明】

【0001】

【発明の属する技術分野】本発明は、各種電気電子機器の短絡等による過電流や過熱に対する回路保護に用いる PTC (Positive Temperature Coefficient = 正の温度係数をもつ) 特性を有する導電性ポリマを用いたチップ形 PTC サーミスタに関するものである。

【0002】

【従来の技術】以下、従来の PTC サーミスタについて説明する。

【0003】従来の PTC サーミスタは、米国特許第 4689475 号公報に、0.1~100 μm の表面粗さをもつ金属箔や表面を粗面化した金属板を平板状に成形した導電性ポリマ (以下、「ポリマ PTC」と記す。) の両面からはさみ、熱圧着する製造方法が開示されている。

【0004】図 6 は従来のチップ形 PTC サーミスタの斜視図である。図において、1 は上・下面に金属箔 2 を設けてなるポリマ PTC である。3 はポリマ PTC 1 と対向する金属箔 2 の面にはんだ層 4 を介して設けられた金属端子である。この時、金属端子 3 の縁端はどちらか一方の面に向かって設けられていた。

【0005】

【発明が解決しようとする課題】しかしながら上記従来の構成では、金属箔 2 と金属端子 3 とははんだ層 4 で接合され、この接合はポリマ PTC の組成物の結晶性ポリマが変質しないように、270℃以下で接合しなければならないため、チップ形 PTC サーミスタをプリント基板に実装する時に使用するはんだと耐熱温度とが同等となり、フロー法によるプリント基板への実装時に接合部のはんだが溶融し金属端子 3 がずれるという課題を有していた。

【0006】上記課題を解決するために本発明は、金属端子のずれないチップ形 PTC サーミスタを提供することを目的とするものである。

【0007】

【課題を解決するための手段】上記目的を達成するために本発明は、基板の上面に一対の T 字型の電極層を備え、この電極層に電気的に接続する導電性ポリマを有するものである。

【0008】

【発明の実施の形態】本発明の請求項 1 に記載の発明は、基板と、前記基板の上面に設けられた一対の T 字型電極層と、前記電極層に電気的に接続する PTC 特性を有する導電性ポリマと、前記基板の側面に前記電極層と電気的に接続する側面電極とからなるものである。

【0009】また、請求項 2 に記載の発明は、請求項 1 記載の導電性ポリマは、結晶性ポリマと導電性粒子との組成物であるものである。

【0010】また、請求項 3 に記載の発明は、請求項 1 記載の発明の導電性ポリマの上面に、電極を備えるものである。

【0011】また、請求項 4 に記載の発明は、請求項 1 記載の発明の基板の下面に、側面電極と電気的に接続する電極を備えたものである。

【0012】(実施の形態 1) 以下、本発明の一実施の形態におけるチップ形 PTC サーミスタについて、図面を参照しながら説明する。

【0013】図 1 は本発明の一実施の形態におけるチップ形 PTC サーミスタの斜視図、図 2 は同要部である導電性ポリマを外した図である。

【0014】図において、11 は表面粗さが 3~4 μm 有する 96% のアルミナを含有してなる基板である。12 は基板 11 の上面に一端から他端、他端から一端に向かって設けられた略 T 字型のニッケルからなる一対の T 字型の電極層である。13 は一対の電極層 12 に電気的に接続するように基板 11 の上面に設けられた結晶性ポリマと導電性粒子との組成物である PTC 特性を有するポリマ PTC である。14 は基板 11 のそれぞれの側面に電極層と電気的に接続するように設けられた銀からなる側面電極である。

【0015】以上のように構成されたチップ形 PTC サーミスタについて、以下にその製造方法を説明する。

【0016】まず、基板 11 の上面に、ニッケル膜をスパッタリング法で形成し、図 2 に示すパターンの一対の電極層 12 となるようにフォトリソエッチングする。

【0017】次に、結晶化度 70~90% の高密度ポリエチレンを 49 重量% とファーネス法で製造した平均粒径 58 μm 、比表面積 38 m^2/g のカーボンブラックを 50 重量%、酸化防止材を 1 重量% を、ヒータで 150℃ に加熱した 2 本ロールにて 20 分間混合し、この混合物を 2 本ロールからシート状で取り出し、厚みを mm に均一にするため金属板で押さえながら冷却しシートを小片に切断したポリマ PTC 13 を電極層 12 を形成した基板 11 の上面に搭載し、190℃ に加熱した熱ブレ

ス機で、 $20\text{kg}/\text{cm}^2$ の圧力で10秒間プレスし、ポリマPTC13を基板11に接合する。ここに得られた接合したポリマPTC13を、電子線照射装置内で20Mrad照射し、高密度ポリエチレンに放射線架橋を施した。

【0018】最後に、基板11の向かい合う側面に、電極層12とつながるようにエポキシ系の銀ペーストを塗布乾燥し、基板11に固着させ、一対の外部電極となる側面電極14を形成して、チップ形PTCサーミスタを得るものである。

【0019】以上のように、構成、製造されたチップ形PTCサーミスタの抵抗温度特性を図3に示す。また、このチップ形PTCサーミスタの常温(25℃)での抵抗値は1.2Ω、通電可能な電流値は0.7Aであった。

【0020】なお、図4に示すように、ポリマPTC13の上面にAgからなる電極21を設けると、比抵抗値が小さくなって良い。

【0021】また、図5に示すように、基板11の下面の側部に側面電極14と電氣的に接続するように電極321を設けると、ポリマPTC13が発熱した時の熱放散性による実装されるプリント基板に対する影響が小さくなって良い。

*

*【0022】

【発明の効果】以上のように本発明は、実装時の加熱に、導電性ポリマと電極と端子が動じることが少ないため、フロー法の実装やリペア作業が可能である。

【0023】また、抵抗値を低くすることができ、あるいは、基板の下面部に厚みを設けた外部電極を形成することにより、熱放散性を一定にできる構造も可能である。

【図面の簡単な説明】

【図1】本発明の一実施の形態におけるチップ形PTCサーミスタの斜視図

【図2】同要部である導電性ポリマを外した図

【図3】同抵抗温度特性を説明する図

【図4】本発明の他の実施の形態におけるチップ形PTCサーミスタの斜視図

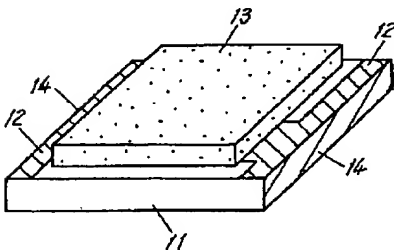
【図5】本発明の他の実施の形態におけるチップ形PTCサーミスタの斜視図

【図6】従来のチップ形PTCサーミスタの斜視図

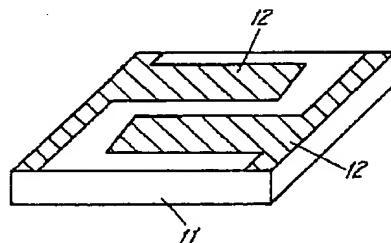
【符号の説明】

- 11 基板
- 12 電極層
- 13 ポリマPTC
- 14 側面電極

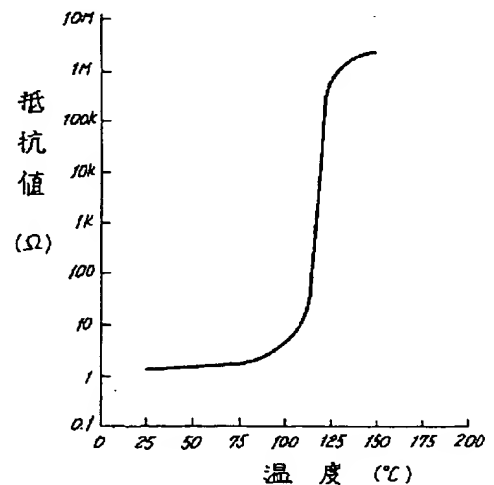
【図1】



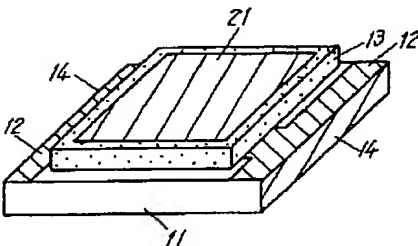
【図2】



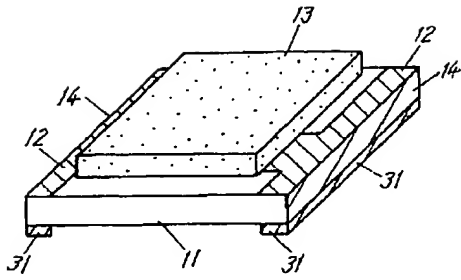
【図3】



【図4】



【図 5】



【図 6】

